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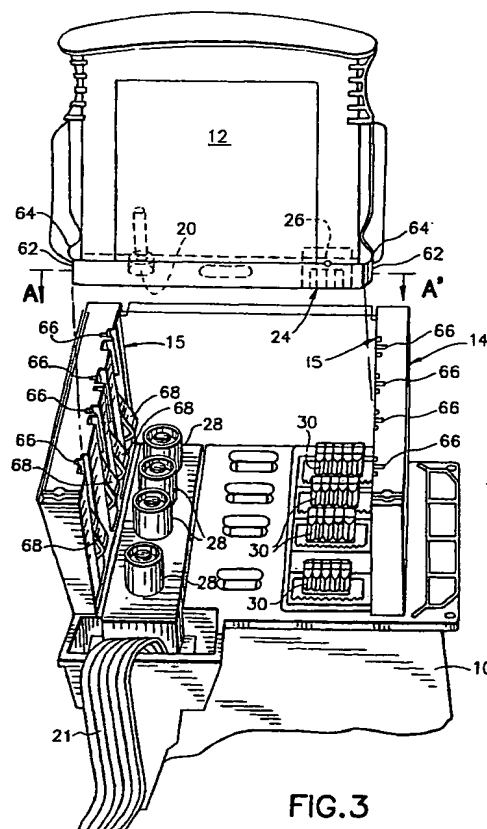
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(54) **Mechanical and electrical keying arrangement for replaceable ink cartridge**

(57) A replaceable ink cartridge (12) for an inkjet printer (10) enables both mechanical and electrical keying. The inkjet printer (10) includes a receptacle (14) for receiving the ink cartridge (12), which receptacle (14) includes a fluidic coupler (28), an electrical connection (30), and a mechanical keying feature (66) for accepting only ink cartridges (12) containing a first class of compatible ink types and for rejecting ink cartridges (12) containing a second class of incompatible ink types. The replaceable ink cartridge (12) includes a casing with a fluidic coupler (20), a reservoir (22) connected to the fluidic coupler (20) for holding an ink supply and an electrical connector (24). A memory (26) is coupled to the electrical connector (24) and stores a parameter from which an identity of an ink stored in the reservoir (22) can be identified. A physical key (62,64) is positioned on a leading portion of the casing of the replaceable ink cartridge (12). A successful insertion of the casing into a receptacle (14) in the printer (10) indicates that the ink type in the reservoir (22) is within the first class of compatible ink types, but not that it is usable with the printer (10). The printer (10) determines usability by reading out the parameter from the memory (26) and determining that the ink identity is one that can be used with the printer (10).

**FIG. 3**
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the mechanical and electronic keying of the invention on a receiving inkjet printer.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 schematically depicts an inkjet printer 10 that includes an ink cartridge 12 which incorporates the invention. Inkjet printer 10 further includes an ink cartridge receiving station 14 which comprises a plurality of cartridge-receiving receptacles 15. An inkjet printhead 16 and a print controller 18 (e.g., a microprocessor) are also included with an inkjet printer 10. Printing is accomplished by printer 10 causing ejection of ink from printhead 16 under control of print controller 18.

Printhead 16 is connected to controller 18 by an electrical link 19. Ink is provided to printhead 16 by way of fluid conduit 21 which fluidically connects to printhead 16 to ink cartridge receiving station 14. Ink container 12 includes a fluidic coupler 20 which is in fluid communication with fluid in ink reservoir 22. Ink cartridge 12 further includes a plurality of electrical contacts 24 which are electrically connected to a memory 26.

Fluidic coupler 20 and electrical contacts 24 allow ink cartridge 12 to reliably interconnect with a fluid inlet coupler 28 and electrical contacts 30, respectively, associated with receptacle 15. Receptacle 15 enables ink to be transferred from ink reservoir 22 to printhead 16, via fluid conduit 21. In addition, receptacle 15 allows the transfer of information between memory 26 and print controller 18 via an electrical link 32.

Fig. 2 depicts a perspective view of inkjet printer 10, with its cover removed, containing plural ink cartridges 12. Printer 10 includes a tray 40 for holding a paper supply. When a printing operation is initiated, a sheet of paper from tray 40 is fed into printer 10, using a sheet feeder (not shown). During printing, paper sheets pass through a print zone 42 whereupon a scanning carriage 44, containing one or more printheads 16, is scanned across the sheet for printing a swath of ink thereon. The sheet of paper is stepped through the print zone 42 as the scanning carriage 44 prints a series of swaths of ink to form images thereon. After printing is complete, the sheet is positioned into an output tray 46 and the process repeats.

Scanning carriage 44 moves through print zone 42 on a scanning mechanism which includes a slide rod 48. A positioning means, such as a coded strip (not shown), is used in conjunction with a photo detector in scanning carriage 44 for precisely positioning scanning carriage 44. A stepper motor (not shown), connected to scanning carriage 44 via a drive belt and pulley arrangement, is used for transporting scanning carriage 44 across print zone 42.

Scanning carriage 44 in Fig. 2 is shown positioned at a nonprinting position, disposed adjacent print zone 42. The nonprinting position is known as a "service station" which maintains printhead 16 to assure optimum print quality over time. Each of printheads 16 is coupled

by a cable (not shown) to print controller 18 that, in turn, controls the print actions thereof.

The present invention relates to apparatus for enabling ink container 12 to be received within a receptacle 15 and to operate with printer 10 only if the ink contained within reservoir 22 is of a compatible type to that utilized by printer 10. As will be understood from the description below, a combination of mechanical and electrical keying is used to accomplish the invention. However, before describing details of the keying arrangement, further description of the structure of ink container 21 and receptacle 15 will be considered.

Ink cartridge 12 is referred to as an off-axis ink supply because it is spaced from a scan axis along which scanning carriage 44 moves. Once ink cartridge 12 is properly inserted and latched into place in a receptacle 15, electrical, mechanical and fluidic interfacing is accomplished with printer 10. Ink passes through the fluid interface in receptacle 15, through fluid conduit 21 (e.g., tubing which fluidically connects ink containers 54, 56, 58 and 60) to corresponding printheads 16 on print scanning carriage 44.

Ink cartridge 12 contains a supply of ink which is either (i) from a first class of inks that are compatible with the receptacle into which ink cartridge 12 is to be inserted or (ii) from a second class of inks that are incompatible. The first class of inks are those which, if brought into contact with a fluidic connector in the receptacle will not damage printer 10. The second class of inks are those which, if allowed into contact with the fluid connector will cause severe damage. Such inks may be of the type which precipitate upon mixing with a previous ink connected to the fluidic connector, have a different colorant, a different viscosity, etc.. For instance, it is critical to prevent mixing of black and color inks in this system.

In Fig. 3, ink cartridge 12 is depicted, positioned for insertion into a receptacle 15 within ink cartridge receiving station 14. Each cartridge 12 includes an aligning/guide feature 62 and a latch feature 64 which provide both alignment, latching and keying functions. The aligning/guide features 62 are preferably positioned on opposite sides of ink cartridge 12. Corresponding aligning feature 66 are disposed at opposite ends of each receptacle 15. The use of aligning/guide 62 on opposite ends of cartridge 14 eliminates any need for partition walls between cartridges 12 during insertion.

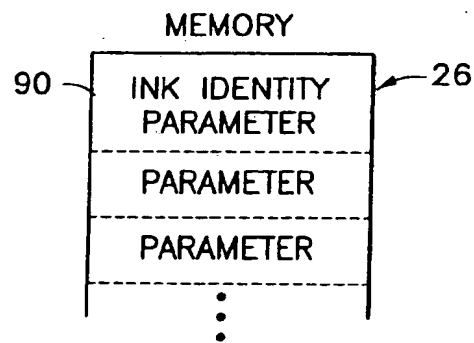
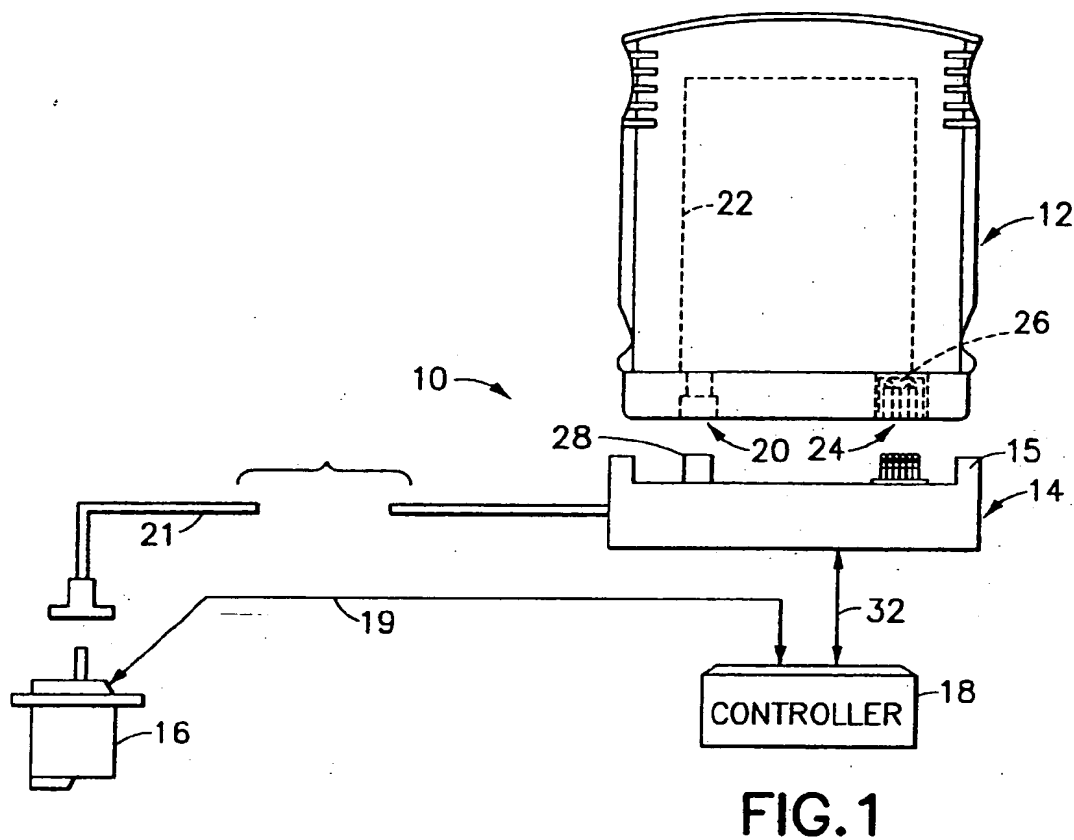
Ink cartridge 12 has an elongate cross section perpendicular to the direction of its insertion into receptacle 15. Aligning features 62 are positioned at opposite ends, with the elongate shape of the cartridge maximizing the distance between the aligning features. Placing the features at these locations minimizes the angular variation between the ink cartridge and the receptacle during insertion, improves alignment of fluid outlet 20 to fluid inlet 28 and improves alignment of connector 24 to connector 30. However, the narrow ends of ink cartridge 12 allow only a minimal number of mechanical keying combina-

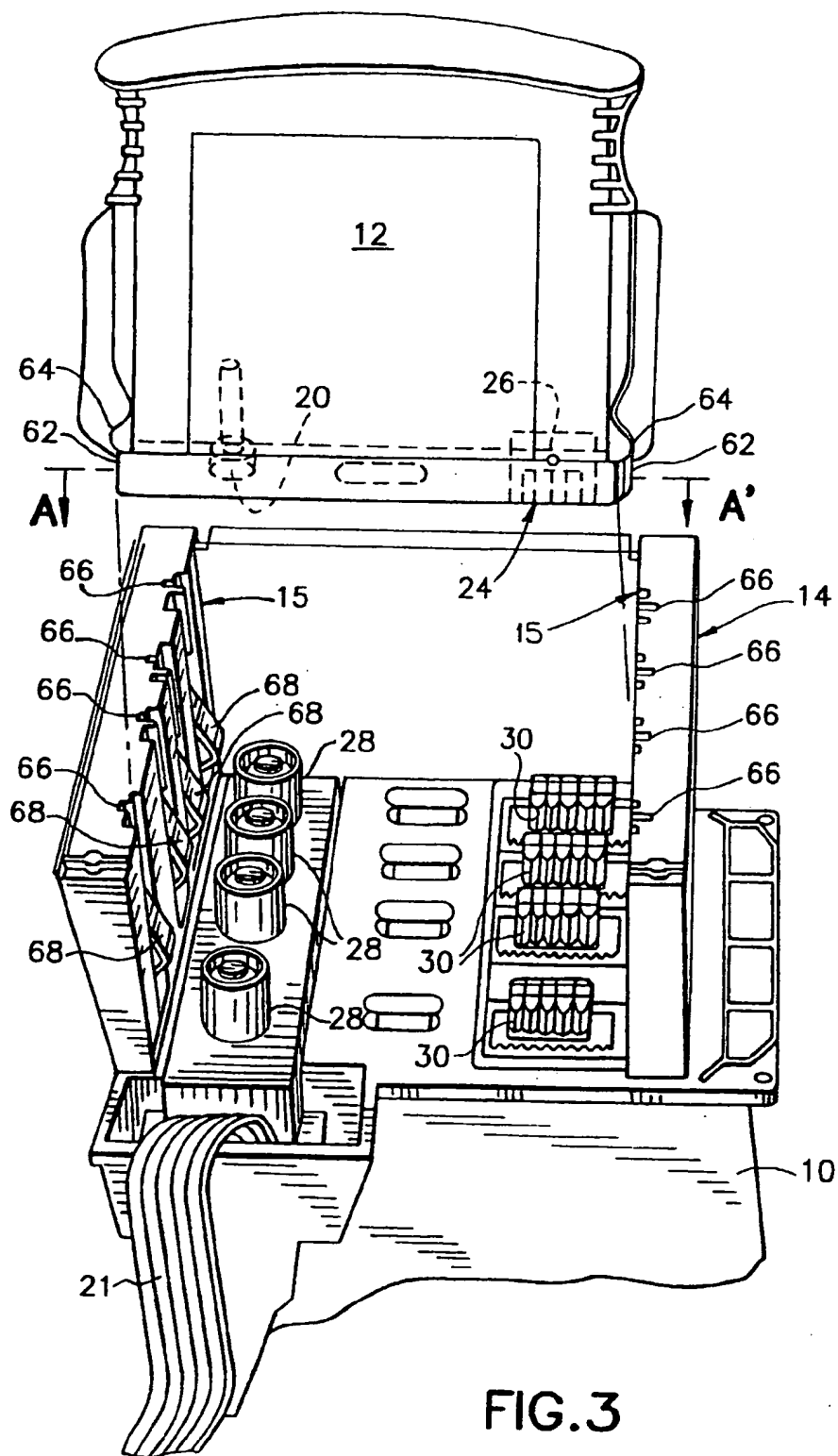
As can be seen from the above, a cartridge 12 will be received into a receptacle 15 only if it contains an ink which falls into a class of inks that will not damage printer 10 as a result of an initial installation. Once received into a receptacle 15, a determination of the ink type is made by controller 18 which allows further use of ink from cartridge 12 only if the ink is fully compatible with printer 10. Otherwise, further use of cartridge 12 is inhibited. The combined mechanical/electrical keying enables a wide range of inks to be discriminated by printer 10 and avoids the need for complex mechanical keying systems.

It should be understood that the foregoing description is only illustrative of the invention. Various alternatives and modifications can be devised by those skilled in the art without departing from the invention. Accordingly, the present invention is intended to embrace all such alternatives, modifications and variances which fall within the scope of the appended claims.

Claims

1. A replaceable ink cartridge (12) for an inkjet printing system (10) having a receptacle (14) positioned to receive an ink cartridge (12), the receptacle (14) including both fluidic coupler means (28) and electrical connection means (30), the receptacle (14) further including a mechanical key feature (66) for accepting only ink cartridges (12) containing a first class of compatible ink types and for rejecting ink cartridges (12) containing a second class of incompatible ink types, said replaceable ink cartridge (12) comprising:
 - a casing including a fluidic coupler (20), a reservoir (22) connected to said fluidic coupler (20) for holding an ink and an electrical connector (24);
 - a memory (26) coupled to said electrical connector (24), for storing an identity parameter from which an identity of an ink stored in said reservoir (22) can be identified;
 - key means (62,64) positioned on a portion of said casing, successful insertion of said casing into a receptacle (14) indicating that an ink type in said reservoir (22) is within said first class of compatible ink types, but not that it is usable with said printer (10), usability being determined by a decoding of said identity parameter by said printer (10) and a determination that the ink identity is one that can be used with the printer (10).
2. The replaceable ink cartridge (12) as recited in claim 1, wherein said key means (62,64) comprises a physical shape which is formed so that upon an attempted insertion of said leading portion of said ink cartridge (12) into said receptacle (14), insertion can only be accomplished if said ink in the reservoir (22) of said cartridge (12) is within said first class of compatible ink types.
3. The replaceable ink cartridge (12) as recited in claim 1, wherein said key means (62,64) comprises a physical shape which is formed so that upon an attempted insertion of said leading portion of said ink cartridge (12) into said receptacle (14), insertion cannot be accomplished if said ink in the reservoir (22) of said cartridge (12) is within said second class of incompatible ink types.
4. The replaceable ink cartridge (12) as recited in claim 1, wherein said identity parameter is a model number assigned to said replaceable ink cartridge (12).
5. A printing system (10) for receiving a replaceable ink cartridge (12), said replaceable ink cartridge (12) comprising a casing including a fluidic coupler (20), a reservoir (22) connected to said fluidic coupler (20) for holding an ink, an electrical connector (24), a memory (26) coupled to said electrical connector (24), for storing an identity parameter from which an identity of an ink stored in said reservoir (22) can be identified, and key means (62,64) positioned on a portion of said casing and identifying a class of ink types to which the ink in said reservoir (22) belongs, said printer system (10) comprising:
 - a receptacle (14) positioned to receive an ink cartridge (12), the receptacle (14) including both fluidic coupler means (28) and electrical connection means (30), the receptacle (14) further including a mechanical key feature (66) for accepting only ink cartridges (12) containing a first class of compatible ink types and for rejecting ink cartridges (12) containing a second class of incompatible ink types; and
 - processor means (18) for reading said identity parameter from said memory (26) via said electrical connector (24), upon successful insertion of said casing into said receptacle (14), and for determining from the identity parameter if ink in said reservoir (22) is an ink that can be used with the printer (10) and only if said ink can be used in said printer (10), enabling full use of said cartridge (12).
6. The printing system (10) as recited in claim 5, wherein if said identity parameter enables said processor means (18) to determine that said ink is not to be used in said printer (10), said processor





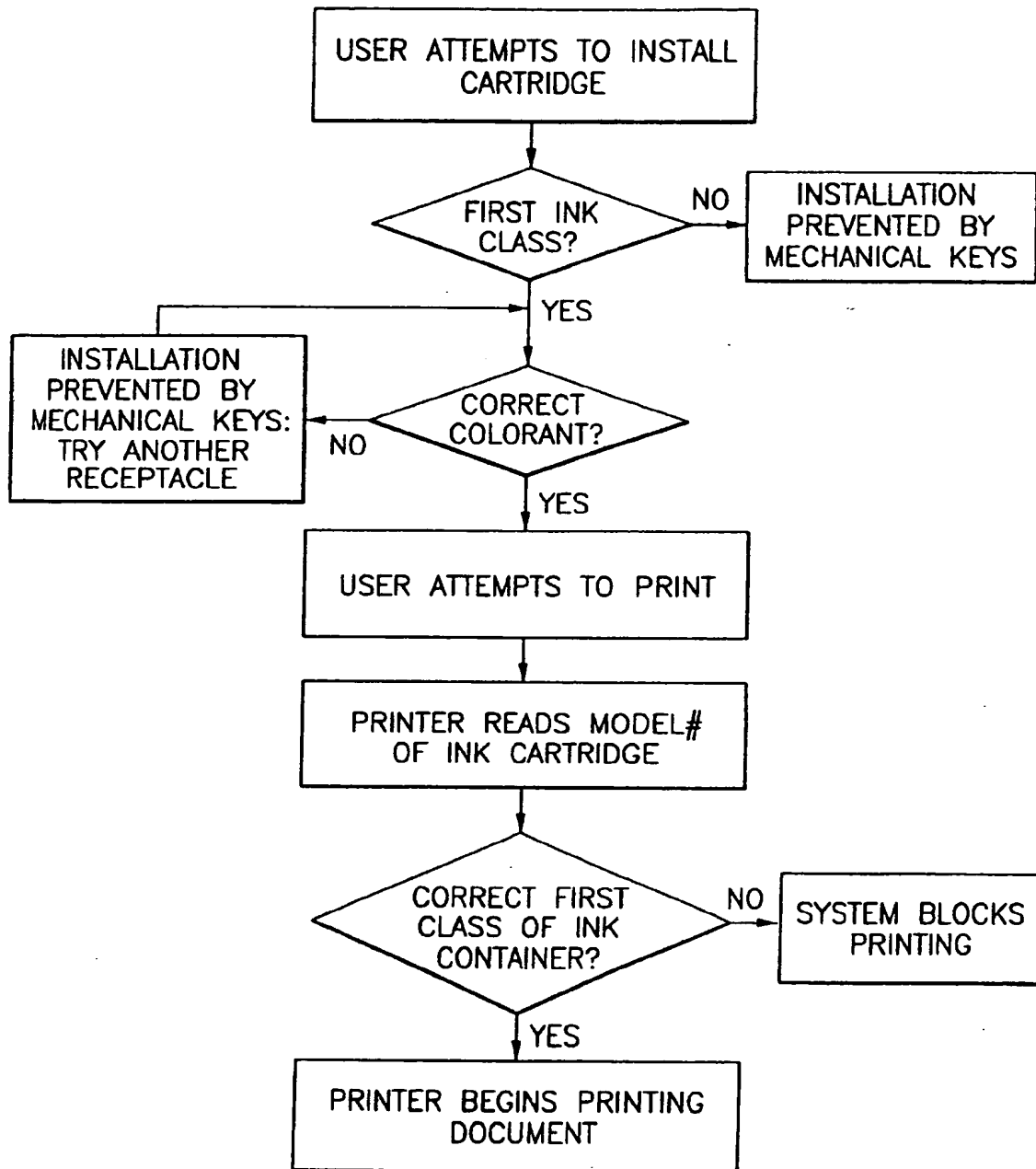


FIG.5

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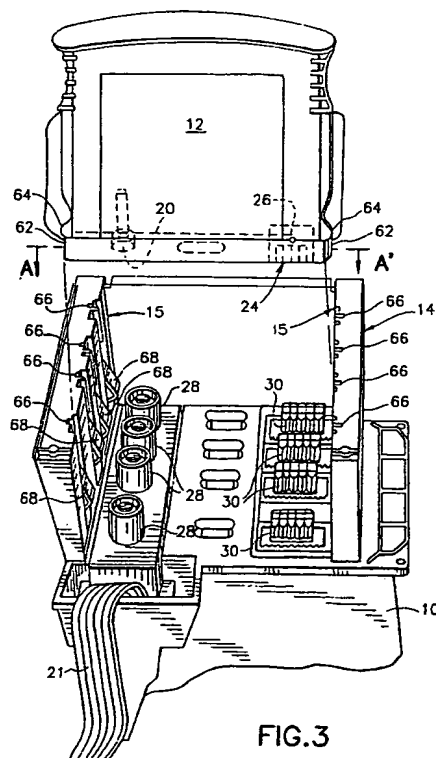


FIG.3